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(54) Contactor

(57) A slurry/liquid contactor has a stationary drum (12) through which the phases pass; and a rotor (14) within the drum comprising a number of axially-spaced discs (16), which divide the drum interior into a series of compartments and which have edges displaced from the drum wall, and a number of buckets (20) carried in each of a succession of the compartments between successive discs (16). The buckets (20) in each compartment are angularly displaced relative to those of adjacent compartments so that the corresponding buckets (20) in successive compartments are helically arranged about the rotor axis (15). The buckets 20, if they have toothed edges as shown, may extend beyond the periphery of discs 16. If the bucket edges are straight,

they lie within the confines of discs 16 to minimize pick-up of undesired solid from the drum bottom.

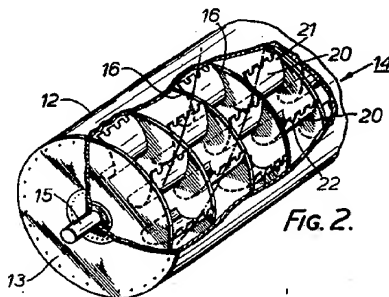


Fig. 2.

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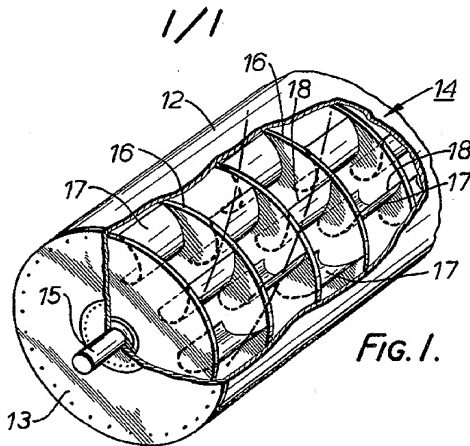


Fig. 1.

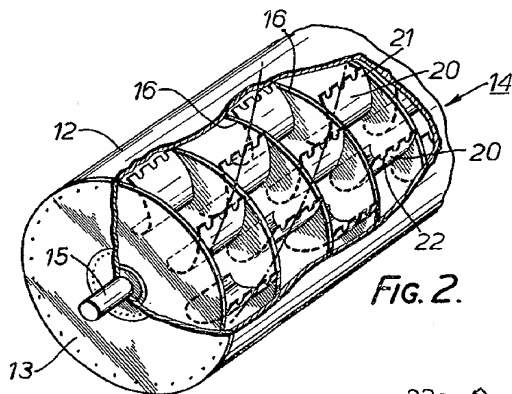


Fig. 2.

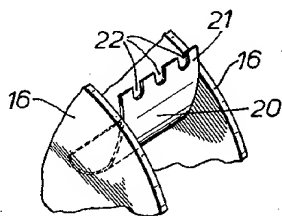


Fig. 3.

SPECIFICATION

Contactor

5 This invention relates to apparatus for contact-
ing materials and is particularly concerned
with a slurry/liquid contactor, in which the
slurry is either introduced into the contactor or
in which a solids phase and a carrier liquid
are separately introduced and a slurry is
10 formed within the contactor. In the contactor,
the slurry is brought intimately and continu-
ally into contact with a treatment liquid phase,
which is substantially immiscible with the car-
rier liquid or the liquid of the slurry and which
15 has a lower specific gravity than that latter
liquid. A contactor of the invention may be
applied to the treatment of oil-sands with hot
water or with a solvent for the bitumen oil
constituents of the oil-sands, in order to ex-
tract the bitumen oils, as described for exam-
20 ple in UK patent specification No. 1527269.
In US patent specification No. 3649209
there is described a solids-liquid contactor
25 comprising a drum through which the phases
can pass, preferably in counter-current, a rotor
within the drum including a plurality of axi-
ally-spaced discs dividing the drum interior
into a series of compartments, the edges of
30 the discs being spaced from the wall of the
drum to form an annular passage for the
movement of the phases from compartment to
compartment, and, for each of at least some
of the compartments, a plurality of receptacles
35 mounted to rotate with the rotor and designed
to receive material of one phase and to dis-
charge it into the other phase as the rotor
turns. When a slurry is treated in such a
contactor, the slurry and the treatment liquid
40 phases travel through the contactor with a
substantially stable interface between the
treatment liquid phase and the liquid of the
slurry, that interface usually being arranged to
pass through the drum axis. The invention is
45 generally concerned with such a contactor.
Because, in the contactor of US patent
specification No. 3649209, the receptacles
are carried within the peripheries of the discs,
there is a serious possibility of the solids of
50 the slurry settling to the bottom of the station-
ary drum and forming a stationary, and often
compacted, layer of solids occupying the an-
nular space between the discs and the drum
over a substantial sector at the lower part of
55 the drum. That layer, if allowed to remain,
obstructs the movement of the slurry through
the drum and prevents the proper operation of
the contactor. In particular, the presence of a
stationary layer of solids increases the pres-
60 sure drop along the drum and may necessitate
the tilting of the axes of the drum and rotor
away from the horizontal, in order to maintain
the interface between the treatment phase and
the liquid of the slurry approximately at the
65 drum axis.

In our British Patent Application No.
42461/78 published under Serial No.
2009614 we have described the use of a
blade or blades carried by the rotor and
70 projecting outwardly beyond the edges of the
discs towards the drum wall. As the rotor
turns, the blade acts to keep the solids in
suspension so that they may be moved axially
along the contactor with the carrier liquid.
75 According to the application, the blade or
each blade may be helical about the rotor axis
in order directly to promote axial movement of
the solids.

If the blades of application No. 42461/78
80 are integral with, or continuations of, the
leading edges of the buckets, there is the
possibility that solids scooped up by the
blades will be directed into the buckets, car-
ried up by them and released in each com-
85 partment, to the detriment of the process
being performed in the contactor.

In one aspect of the present invention, we
dispense with the use of a blade or blades
penetrating the drum-discs space and, in-
90 stead, arrange the corresponding receptacles
in successive compartments in a helix about
the rotor axis. Thus, according to that aspect
of the invention, a contactor comprises a
drum through which the phases to be con-
95 tacted pass; a rotor within the drum including
a plurality of axially-spaced discs which divide
the drum interior into a series of compart-
ments and which have no central openings,
the edges of the discs being spaced from the
100 wall of the drum to form annular passages for
the movement of the phases from compart-
ment to compartment; and a plurality of re-
ceptacles mounted to rotate with the rotor and
designed to receive material of each phase
105 and to shower it into the other phase as the
rotor turns, the corresponding receptacles in
successive compartments being arranged heli-
cally about the rotor axis.

The receptacles may be arranged with their
110 leading edges parallel to the axis of the rotor,
in which case corresponding receptacles in
successive compartments are displaced angu-
larly from one another. Alternatively the lead-
ing edge of each bucket may be formed as
115 part of a helix, so that the leading edges of
receptacles in successive compartments from
a continuous or near-continuous helix. In ei-
ther case, no impelling blade entering the
drum-discs space is carried by the rotor, con-
120 trary to the disclosure of the above patent
application, the helical disposition of the buc-
kets themselves resulting in a screwing action
on the liquid in the annular space between
the drum and the discs and thus promoting
125 movement of the solids.

The receptacles are preferably similar to
those described in the above patent applica-
tion, i.e. their leading edges are disposed
close to the cylinder on which the disc edges
130 lie and the receptacles are secured between

successive discs.

In some applications, it is undesirable that the solids at the bottom of the drum should be carried up and released in each compartment. To avoid that occurrence, each of at least some of the buckets preferably has one or more slots in it, opening to the leading edge of the bucket. Then, any solids captured by the leading edge of a bucket at the bottom of the drum fall through the slot or slots as the rotor turns and before those solids are lifted to any extent.

Provided that the above mentioned slots are present, the leading edges of the helically arranged buckets may be extended beyond the edges of the discs and into the drum-discs annular space, since the presence of the slots minimises the amount of solids carried up and released by the buckets. Thus, a second aspect of the invention resides in a contactor comprising a drum through which the phases to be contacted pass; a rotor within the drum including a plurality of axially-spaced discs which divide the drum interior into a series of compartments and which have no central openings, the edges of the discs being spaced from the wall of the drum to form annular passages for the movement of the phases from compartment to compartment; and a plurality of receptacles mounted to rotate with the rotor and designed to receive material of each phase and to shower it into the other phase as the rotor turns, each receptacle having a leading edge which extends into the drum-disc space and which has at least one slot cut into it to reduce the amount of solids raised by the leading edge.

The invention will be more readily understood by way of example from the following description of contactors in accordance therewith, reference being made to the accompanying drawing, in which

Figure 1 is a part cut-away perspective view of a contactor having buckets which do not extend into the drum-rotor space.

Figure 2 is a similar view of contactor having buckets the leading edges of which project into the drum-rotor space, and

Figure 3 is a perspective view of a bucket of Fig. 2 on enlarged scale.

The contactors are generally as described in the above numbered patent specifications except for the contactor buckets. Thus the contactor in each of Figs. 1 and 2 has a stationary drum 12 closed by end plates one of which is shown at 13, and a rotor 14 carried on a shaft 15 passing through the end plates 13. The rotor consists of a series of parallel, axially spaced, discs 16, the edges of which are spaced from the drum 12, and which define a number of compartments; in each such compartment buckets are carried between successive discs as shown.

In Fig. 1, the buckets are indicated at 17 and it will be seen that the leading edge 18 of

each bucket does not project beyond the cylinder on which the edges of the discs 16 lie. The buckets in each compartment are circumferentially displaced from the corresponding buckets in the previous compartment, so that corresponding buckets in successive compartments are disposed in a helix about the rotor axis. The helix angle is chosen according to the nature of the solids to be treated and the process; for example, Fig. 1 shows eight buckets in each compartment, with $\frac{1}{2}$ pitch displacement from compartment to compartment.

In Figs. 2 and 3, the buckets, indicated at 20, are circumferentially displaced from compartment to compartment similarly to Fig. 1, but in addition the leading edge 21 of each bucket projects into the rotor-drum space so as to reach any layer of solids settled at the bottom of the drum. To avoid the solids scooped up by the projecting parts of the bucket being carried right up the contactor, the leading edge of each bucket has cut-outs 22 through which the solids fall as they are lifted.

CLAIMS

1. A slurry/liquid contactor comprising a drum through which the phases to be contacted pass; a rotor within the drum including a plurality of axially-spaced discs which divide the drum interior into a series of compartments and which have no central openings, the edges of the discs being spaced from the wall of the drum to form annular passages for the movement of the phases from compartment to compartment; and a plurality of receptacles mounted within a succession of the compartments to rotate with the rotor and designed to receive material of each phase and to shower it into the other phase as the rotor turns, the corresponding receptacles in the successive compartments being arranged helically about the rotor axis.

2. A contactor according to claim 1, in which the receptacles are arranged with their leading edges parallel to the axis of the rotor, and in which corresponding receptacles in successive compartments are displaced angularly from one another.

3. A contactor according to claim 1, in which the leading edge of each receptacle is formed as part of a helix, and the leading edges of receptacles in successive compartments form a continuous or near-continuous helix.

4. A contactor according to any one of the preceding claims in which the leading edges of the receptacles are disposed on or close to the cylinder on which the disc edges lie and the receptacles are secured between successive discs.

5. A contactor according to any one of the preceding claims, in which each of at least some of the receptacles has one or more slots

in it, opening to the leading edge of the bucket, to permit any solids captured by the leading edge of a receptacle at the bottom of the drum to fall through the slot or slots as the rotor turns and before those solids are lifted to any great extent.

5 6. A contactor according to any one of claims 1 to 3, in which the leading edge of each receptacle extends beyond the edges of
10 the discs and has at least one slot cut into it to reduce the amount of solids raised by the leading edge.

7. A slurry/liquid contactor, substantially
15 as herein described with reference to the accompanying drawings.

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